ISAT-200 Installation Manual

DOC0334

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Applies to PN: 101-200-01, 101-200-03 (ISAT-200)
102-200-01 (ITRAY-200)

July 27, 2012

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Caution

The ISAT-200 contains static sensitive circuitry that could be damaged from large electro static discharges directly into the ARINC 404 connector pins. Use care when handling the ISAT-200 not to touch the connector pins unless properly grounded.

Warning

Changes or modifications not expressly approved by SkyTrac Systems Ltd (STS) could void the user's authority to operate the equipment.

Warranty Information

SkyTrac Systems Ltd warrants this product to be free of defects in materials and workmanship, and that the product meets or exceeds approved factory acceptance test requirements. STS reserves the right to replace any warranted product at its sole discretion during the warranty period.

The ISAT-200 Airborne Data/Position Communicator (except for the Li-ion battery P/N: STS0044 or STS0061) and ITRAY-200 Installation Kit are under warranty for one year from date of shipment from SkyTrac Systems. For failed units caused by defective parts or workmanship, contact SkyTrac Systems for an RMA #. Once an RMA # has been obtained, the unit should be returned to:

SkyTrac Systems Ltd.
#200-170 Rutland Road North
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1 GENERAL

1.1 Introduction

This manual contains information and instructions required to install the ISAT-200 Position/Data Communicator System and more specifically, its primary component the ISAT-200 Transceiver.

1.2 Contents

This manual contains procedures and other information for installing the ISAT-200 system. It is divided into the following sections:

Section 1 – General

This section contains a product overview and an overview of the contents of this manual. It also lists the ISAT-200 system components, for which installation procedures are included.

Section 2 — System Specifications

This section contains tables that list the power requirements and electrical specifications for the components of the ISAT-200 system.

Section 3 — Mechanical Installation

This section contains the procedures for the physical installation of the ISAT-200 system components.

Section 4 — Electrical Installation

This section contains the information needed to complete the electrical connections in an ISAT-200 system.

Section 5 — Configuration of the ISAT-200

This section contains instructions on how to configure and set up the ISAT-200 system.

Section 6 — Post Installation Tests

This section contains instructions for tests to be performed after installation, to confirm that the system has been installed correctly.

Section 7 — Airworthiness Limitations

This section describes the installation and operational limitations of the ISAT-200 system.

Section 8 — Maintenance and Continued Airworthiness

This section describes the steps required for the continued airworthiness of the ISAT-200 system.

Section 9 — Firmware Updates

This section indicates the methods available to update the ISAT-200 and where to find the required instructions.

Section 10 — ISAT-200 Human Machine Interface

This section provides a brief description of the ISAT-200 human machine interface components.

Section 11 — Appendices

1.2.1 Audience

This manual is intended for qualified aircraft avionics installation technicians, (referred to as *installers*). It assumes that the installer is familiar with the tools, materials, and techniques of wiring and metal work required for installing radios, antennas, and related components into aircraft.

1.2.2 References

More detailed information about the ISAT-200 system can be found in the SkyWeb documentation section of the SkyTrac Website (www.skytrac.ca)

1.3 ISAT-200 System Components

The following paragraphs describe the components of the ISAT-200 system.

1.3.1 ISAT-200

The ISAT-200 is the primary component of the ISAT-200 System. The system is comprised of a GPS (Global Positioning System) receiver, an L-Band transceiver specifically designed to communicate with the Iridium® satellite system, a Lithium-ion battery which enables communications with the satellite system after airframe power shutdown, and a battery charging system. Control and interfacing are provided with a low power, single-board computer.

The ISAT-200 provides position reporting and messaging with global coverage in near real time.

Figure 1— ISAT-200 System Block Diagram

The ISAT-200 is the primary hardware component of a system designed to provide full duplex sat phone communication, automatic message reporting, 2-way messaging and other data transfers. Data can be sent between an aircraft and any point in the world with internet access via the Iridium® Low Earth Orbit (LEO) satellites. Position reports and text messages from the aircraft can be displayed on any computer with internet access and SkyTrac software. Position reporting intervals are user-defined. Base software displays current and historical position data including latitude, longitude, GPS time, relative position (to a known way point), ground speed, altitude and heading, in tabular format and on a map. Airtime, flight time, ETA, distance traveled, time elapsed and other flight data is also displayed for instant viewing. Flight reports can also be generated by unit and time frame (i.e. airtime/flight time per day/week/month).

Operationally, the ISAT system can compliment flight following requirements for commercial operators and provide vital position data and messaging services to those operators conducting flight activities in remote areas.

The unit may be reprogrammed via the USB port or the SD Card Interface in order to provide new feature sets as they become available.

The eight character display and user-friendly menu system is provided to enable troubleshooting with minimal reference to the manual required.

The unit supports up to two RS-232 serial ports, up to two RS-485 ports, Ethernet, three analog inputs, and six digital inputs.

The ISAT-200 supports sat phone integration into aircraft standard audio equipment.

1.3.2 ITRAY-200

The ISAT-200 is mounted in an ITRAY-200 quick disconnect chassis. The ITRAY-200 makes for easier replacement and maintenance of the ISAT-200. The ITRAY-200 onboard Configuration Module retains the configuration information related to the airframe, so that if the ISAT-200 is replaced, the new unit will be easily reconfigured.

If an ISAT-200 is moved from one ITRAY-200 to another, the ISAT-200 will automatically use the configuration contained in the new ITRAY-200.

Note: If an ISAT-200R Mod None is installed in an ITRAY-200R Mod A, then the ISAT-200 MB software must be upgraded to a version greater than 00.11.13.

1.3.3 Antenna

The SkyTrac combination antenna combines both an Iridium antenna and a GPS antenna into a single package with a small footprint. The antenna is qualified to TSO-C144. This simplifies aircraft installation.

It is recommended that only the SkyTrac combination antenna be used with the ISAT-200 system. If you wish to use an antenna other than the one provided; please contact SkyTrac Systems for assistance.

1.3.4 ISAT-200 Installation Components

The necessary pins required to populate the ITRAY-200 connectors are included with the ITRAY-200 as well as the connectors required to install the SkyTrac combination antenna.

1.3.5 ISAT-200 Models

Table 1– ISAT-200 Models

Type	Part Number	Description	Compatibility
ISAT-200R	101-200-01	ISAT-200 with ARINC404 connector, - qualified to RTCA/DO-160E.	102-200-01
ISAT-200R	101-200-03	ISAT-200 with ARINC404 connector, - qualified to RTCA/DO-160F	102-200-01
ITRAY-200R	102-200-01	ITRAY/Installation Kit for ISAT-200R	101-200-01, 101-200-03

Note: ISAT-200S (101-200-02, 101-200-04) and ITRAY-200S (102-200-02) have been discontinued.

Table 2– ISAT-200 System Components

Type	Part Num	Description	Compatibility
Li-ion 7.2V	STS0044 or STS0061	2 Cell Li-Ion Battery Pack	101-200-01, 101-200-03
STS-ISAT-ANT	STS-ISAT-ANT	SkyTrac TSO Iridium/GPS Antenna	101-200-01, 101-200-03

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1.3.6 ISAT-200 Supported Peripheral Devices

The ISAT-200 supports the following SkyTrac Systems control head product series:

- DVI-250C and DVI-250A
- CDP-250G and CDP-250C
- Combination of the CDP-250 and DVI-250.
- DVI-300C and DVI-300A
- CDP-300G and CDP-300C
- Combination of the CDP-300 and DVI-300.

It is recommended that a DVI-300 and CDP-300 be used in conjunction to make full use of the ISAT-200 features. Additional peripherals may become available from time to time. Please go to www.skytrac.ca or contact SkyTrac Client Services for more information.

Table 3– ISAT-200 Supported Peripherals

Type	Part Number	Description	Compatibility [1]
DVI-250C Mod A[2]	STS0009	DVI-250 NVIS Friendly	101-200-01, 101-200-03
DVI-250A Mod A[2]	STS0010	DVI-250 NVIS Compatible	
DVI-250CP Mod A[2]	STS0022	DVI-250 NVIS Friendly, Push Button	
DVI-250AP Mod A[2]	STS0023	DVI-250 NVIS Compatible, Push Button	
CDP-250G Mod A[2]	STS0014	CDP-250 Commercial	
CDP-250C Mod A[2]	STS0015	CDP-250 NVIS Friendly	
CDU-250[2]		All CDU-250s are comprised of a combination of the above DVI-250 and CDP-250 models.	
DVI-300C	105-300-01	DVI-300 NVIS Friendly	
DVI-300A	105-300-02	DVI-300 NVIS Compatible	
DVI-300CP	105-300-03	DVI-300 NVIS Friendly, Push Button	
DVI-300AP	105-300-04	DVI-300 NVIS Compatible, Push Button	
CDP-300G	104-300-01	CDP-300 Commercial	
CDP-300C	104-300-02	CDP-300 NVIS Friendly	
CDU-300		All CDU-300s are comprised of a combination of the above DVI-300 and CDP-300 models.	

[1]Note – Please refer to the latest version of the List of Approved Embedded Software (DOC0444) for software version requirements for peripherals. This document can be obtained at www.skytrac.ca or your program manager.

[2]Note – The CDP-250 and DVI-250 require a special version of firmware to communicate with the ISAT-200. Contact SkyTrac Client Services for more information.

2 SYSTEM SPECIFICATIONS

2.1 General

This section contains tables that list the physical and electrical requirements and specifications of each component in the ISAT-200 system.

2.2 Power Requirements for the ISAT-200 System

Table 4— Power Requirements

Component	Power Requirements
ISAT-200	Input Voltage: 10 to 32 VDC, 28 VDC nominal Average Power: 14 W typical, 25W maximum

2.3 Audio Interface

Table 5— Audio Interface Specifications

Audio Output	150 mW minimum into 600 or 300 ohm.
Side Tone	Software Enabled
Microphone	Carbon or Equivalent
Microphone Input	0.007 Vrms to 1.4 Vrms maximum.
Microphone Input Impedance	1K ohms
Microphone Excitation	Software Enabled Bias: 10 VDC maximum
Protection	Audio output short circuit protected

2.4 Digital and Analogue I/Os

Table 6— Digital and Analog I/Os

Ground Seeking Digital Inputs	100 Ohms max for ground state, Maximum: 35 VDC
Voltage Seeking Digital Input	> 5 Volts for logic high, Maximum: 40 VDC
Analogue Inputs	Maximum: 40 VDC
Current Sinking Outputs	Maximum: 36 VDC, 200 mA
Aux Power Output	6 Volts, 0.8 A output
RS-232 Ports	Meets requirements of TIA/EIA-232-F standard TX maximum: +/- 13.2 V, RX maximum: +/- 25V
RS-485 Ports	Meets requirements of TIA/EIA−485−A standard Extended Common Mode: -20V to 25 V Fail-safe receiver: Open circuit, short circuit, bus idle

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2.5 Physical Specifications

Table 7— ISAT-200 and ITRAY-200 Physical Specifications

Operating Temperature	-20ºC to +55ºC[1]
Short Term (30 minutes) Low Temperature	-40ºC
Short Term (30 minutes) High Temperature	+70ºC
Operating Altitude	Max. Operating= 55,000 ft
Size (ISAT-200)	H: 5.0 in W: 3.6 in D: 8.0 in
Size (ITRAY-200)	H:4.41 in W:3.91 in D: 11.8 in
Size (ISAT-200 mounted in ITRAY-200)	H: 5.25 in W: 3.91 in D: 12.1 in
Weight (ISAT-200)	3.8 lb
Weight (ITRAY-200)	1.0 lb
Weight (ISAT-200 mounted in ITRAY-200)	4.8lb
Mounting Orientation	The ISAT-200 mounts into the ITRAY-200. The ITRAY-200 can be mounted in any orientation.

Note 1: Refer to the Operation Limitations section of this document for information regarding battery operating limits.

Table 8— GPS Receiver Specifications

Receiving Method	12 Channel, continuous tracking receiver
Acquisition time	39.4 seconds after power up (cold start) 2 seconds for re-acquisition
Position accuracy	Less than 5 m, 90% of the time[1]

Note 1: Resolution reported in position packets may be less to save transmission costs.

Table 9— Satellite Transceiver Specifications

Operating frequency	1616 MHz to 1626.5 MHz
RF Power*****	Transmit (max) 7W
Input/Output Impedance	50 Ω
Duplexing Method	TDD
Multiplexing Method	TDMA/FDMA

***** The ISAT-200 is not classified as “Equipment known to have a high potential for interference” in accordance with FAA Policy No.: ASW-2001-01 dated April 25, 2002. Separate FADEC testing is not required for this installation.

Table 10— TSO Combination Antenna Specifications (PN: STS-ISAT-ANT)

Description	Active L1 GPS/Passive Iridium Antenna, low profile, moulded radome
Height	0.721 in.
Length	5.026 in.
Width	2.0 in.
Weight	8.0 oz
Voltage	2.8 to 28.0 VDC @ 50 mA max
Gain (GPS antenna):	32 dB min

Table 11— Li-ion Battery Specifications

	STS0061	STS0044
Description	2 cell Li-ion battery pack with built-in protection circuitry	2 cell Li-ion battery pack with built-in protection circuitry
Capacity	7.2V nominal 2700 mAh	7.2V nominal 2250 mAh
Operation	-10℃ to +60℃[1]	-20℃ to +60℃[1]
Charging:	0℃ to +45℃[2]	0℃ to +45℃[2]
Storage:	-20℃ to +60℃ [3]	-20℃ to +60℃ [3]
Dimensions:	5.2 in x 0.90 in x 0.75 in	5.2 in x 0.90 in x 0.75 in
Weight	0.22 lb	0.215 lb
Connector	MOLEX 43025-0400	MOLEX 43025-0400
Over Discharge Protection:	2.32 Volts/cell	2.2 Volts/cell
Over Charge Protection:	4.325 Volts/cell	4.375 Volts/cell
Over Current Protection:	6.5A max	7A max
Over Temperature Protection:	Built-in thermal protection circuit disables cell in case of overheating	Built-in thermal protection circuit disables cell in case of overheating

Note 1 – Operating the battery pack below -10° C results in reduced performance. Operating the battery pack above +60°C may cause reduced life and capacity of the battery.

Note 2- The ISAT-200 has a built-in protection circuit to prevent charging outside of the battery charging operational range.

Note 3 - Store batteries at room temperature at 30-50% of capacity for maximum battery life.

Please refer to Appendix B: Battery Precautions for additional information on operating conditions.

2.6 Safety Compliance

The ISAT-200 and ITRAY-200 have been tested to meet the following RTCA/DO-160 categories.

Part Number 101-200-01 (ISAT-200R) has been tested to the RTCA/DO-160E environmental categories as follows:

DO-160E Env. Cat. (F1)-BAB[(SBM)(UG)]XXXXXXZBBXXXLXXXXX

Part Numbers 101-200-03 (ISAT-200R) and 102-200-01 (ITRAY-200R) have been tested to the RTCA/DO-160F environmental categories as follows:

DO-160F Env. Cat. (F1)-BAB[(SBM)(UG)]XXXXXXZ(BX)BXXXMXXXXX

The tests demonstrated that the ISAT-200 and ITRAY-200 do not exhibit any unsafe performance when exposed to the specified environmental test conditions, and that installation of the ISAT-200 and ITRAY-200 in accordance with the installation instructions in this Manual will not pose a hazard to the continued safe flight and landing of the aircraft.

2.6.1 Environmental Test Summary

The following table summarizes RTCA/DO-160 Environmental Testing for the SkyTrac ISAT-200 Airborne Position/Data Communicator and for the ITRAY-200.

Table 12— Environmental Testing Summary

ISAT-200 Part Numbers:		**101-200-01**	**101-200-03**
ITRAY-200 Part Numbers:			**102-200-01**
DO-160 Revision		**RTCA/DO-160E Category**	**RTCA/DO-160F Category**
Section	**Test Name**		
4.0	Temperature & Altitude	(F1)	(F1)
4.5.4	In-Flight Loss of Cooling	-	-
5.0	Temperature Variation	B	B
6.0	Humidity	A	A
7.0	Operational Shock & Crash Safety	B	B
8.0	Vibration	(SBM)(UG)	(SBM)(UG)
9.0	Explosion Proofness	X	X
10.0	Water Proofness	X	X
11.0	Fluids Susceptibility	X	X
12.0	Sand and Dust	X	X
13.0	Fungus Resistance	X	X
14.0	Salt Spray	X	X
15.0	Magnetic Effect	Z	Z
16.0	Power Input	B	(BX)
17.0	Voltage Spike	B	B
18.0	AF Susceptibility	X	X
19.0	Induced Signal Susceptibility	X	X
20.0	RF Susceptibility	X	X
21.0	RF Emissions	L	M
22.0	Lightning Induced Transient Susceptibility	X	X
23.0	Lightning Direct Effects	X	X
24.0	Icing	X	X
25.0	Electrostatic Discharge	X	X
26.0	Fire, Flammability	X	X

2.7 Emissions Compliance

The following table summarizes the ISAT-200 system's compliance for emissions:

Table 13— Emissions Compliance

Entity	Document Title
US FCC	47 Code of Federal Regulations, Part 25, FCC ID: Q639522B
US FCC	Federal Regulations, Part 15
ETSI	EN 301 489

The 9522B Iridium modem is designed to comply with the standards for Radio Emissions Compliance, Electromagnetic Compatibility, and AC Safety in the United States, European Union and Canada.

IMPORTANT:
To comply with FCC RF exposure requirements, a minimum separation of 20 cm is required between the antenna and all persons.

3 MECHANICAL INSTALLATION

3.1 General

This section contains procedures for the mechanical installation of the ISAT-200 system components. It includes unpacking instructions, a table listing the weight of each component, and instructions for completing the physical installation of the ISAT-200, the ITRAY-200, and the TSO Combination Antenna**.**

The ISAT-200 installation package contains a combination GPS/Iridium antenna. The antenna must be placed in a location that has a clear view of the sky. The ISAT-200 must receive GPS signals via the antenna to enable the determination of its present position and communicate (send/transmit) with the Iridium® LEO satellite system.

In order to view position data, a Windows-based PC is required at the base location. Please see www.skytrac.ca for software options.

3.2 Unpacking and Inspecting the System Components

1. Check the items in the shipment against those listed on the shipping invoice to ensure that all items have been received. If any items are missing, contact SkyTrac Client Services.

2. Carefully remove each item from its individual packaging.

3. Inspect each item for damage that may have been incurred during shipping. In case it is necessary to submit a damage claim, save the shipping container to help verify the claim.

4. After all items have been unpacked, it is suggested that you save the containers and packaging materials in case it becomes necessary to reship an item.

Verify and record the IMEI and the serial number of the ISAT-200.

3.3 Installation Limitations

The following installation regulations must be adhered to:

- The ISAT-200 must be installed using an ITRAY-200 (P/N: 102-200-01) mounted securely.

CAUTION:
As per FAA Policy, No. ASW-2001-01 dated April 25, 2002:
The antenna must not be installed 0.5 meters or less from a FADEC system**.**

3.4 Main Installation Tasks

The main tasks for this installation are listed below:

1. **Unpack and inspect the system components**. Check the contents of the installation kit against the parts list on the Installation Kit Package and verify that all components are included and were not damaged during shipping.

2. Determine the approximate location of the ISAT-200 and combination GPS/Passive Iridium antenna.

   Note: Consider maximum antenna coax lengths and minimum distance between existing GPS antennas and the ISAT-200 antenna when determining an install location.

   Note: If ISAT-200 is to be installed near an active INMARSAT terminal, or if the aircraft that the ISAT-200 is installed in operates near an active INMARSAT terminal, please see Appendix A.

3. **Install and secure the ITRAY-200**.

4. **Install the TSO combination antenna (PN: STS-ISAT-ANT).** Route the coax cables for Iridium and GPS antenna signals to the ISAT-200 combination antenna.

5. **Install and/or connect the battery in the ISAT-200**.

6. **Install and secure the ISAT-200 into the ITRAY-200**.

IMPORTANT NOTICE:
All system interconnect cables must be connected before power is applied to the system.

3.5 ISAT-200 Component Weights

The following table gives the weight for each component of the ISAT-200 system.

Table 14— Component Weights

Component	Weight
ISAT-200R	3.8 lb
ITRAY-200R	1.0 lb
Installation Materials	0.2 lb
TSO Combination Antenna (PN:STS-ISAT-ANT)	0.5 lb
2 Cell Li-Ion Battery Pack	STS0044: 0.215 lb STS0061: 0.22 lb

3.6 Installation Materials

3.6.1 PN: 102-200-01, Installation Kit for the ISAT-200R

The ISAT-200R is installed using the Installation Kit PN: 102-200-01; the kit contains the ITRAY - 200R with the Configuration Module and ARINC connectors already installed, the contacts and back shell. Follow installation instructions as per sections 3.7 and 3.8.

3.7 Installing ITRAY-200

The ISAT-200 is to be installed in an ITRAY-200 for operation. Operation of the ISAT-200 outside the ITRAY-200 is not supported. Note that the configuration module comes already installed on the ITRAY-200.

1. Select a convenient location for installing the tray. The tray can be mounted in any orientation. Allow sufficient space at the rear of the tray for cable and connector routing.

2. Attach the tray to the surface using four AN3 type bolts with lock nuts.

3. Attach the cables to the ITRAY-200 as per an approved wiring diagram.

3.8 Installing TSO Combination Antenna

3.8.1 General Notes

The Iridium® satellite serving a Short Burst Data call can literally be anywhere in orbit at a given moment in time. For this reason, it is imperative that the antenna be mounted outside, as high as possible, in a horizontal position on the aircraft, attempting to achieve a 360-degree view of the sky with minimal obstructions.

The ISAT-200 uses the STS-ISAT-ANT combination active L1 GPS/Passive Iridium low profile, molded radome antenna. This recommended system antenna is only available directly from SkyTrac Systems Ltd. and is permanently installed on the outside of the aircraft. If required, please contact SkyTrac Systems to discuss the feasibility of using an alternate antenna.

3.8.2 Antenna Installation Instructions

The combination antenna must be installed <u>at least three feet away</u> from any other GPS antenna. It is imperative that the antenna be mounted outside, as high as possible, in a horizontal position on the aircraft, attempting to achieve a 360-degree view of the sky with minimal obstructions.

IMPORTANT NOTE:
This antenna uses an SMA connector for the GPS jack and TNC connectors for the L-Band or Iridium jack. Immediate damage will occur to the ISAT-200 if either cable is connected to the wrong coax pin on the ITRAY-200 connector.

The use of RG-400 low-loss coaxial cable restricts the maximum length of the cable to 18 ft. If a longer run is required, use lower loss coax cable such as EMTEQ PFLX240-500 (recommended) or ECS 311501 and refer to manufacturer's specifications for attenuation at 1.6 GHz. Attenuation of equal to or less than 3 dB is required. The bond between the airframe and the antenna needs to be 10 milliohms or less.

Prepare the mounting location by drilling holes in the aircraft skin or through a mounting plate. Use a doubler plate of 4 x 6 inches if the antenna is installed on a non-metallic aircraft surface to create a ground plane. The plate must have an electrical connection to the antenna ground.

Installation of an antenna on the aircraft should be performed only as defined by the aircraft manufacturer or in accordance with TC or FAA approved engineering data. Special caution must be observed when installing antennae in pressurized aircraft.

Note: The combination antenna includes a rubber seal that must be properly installed into the groove on the underside of the antenna prior to mounting the antenna. This seal acts as an environmental seal from the outside atmosphere. Any connections that are not protected from the outside atmosphere by the rubber antenna seal should have an environmental seal applied to them during installation.

Note: The ARINC connectors supplied on the ITRAY-200R use size 5 coax contacts. The contacts supplied in the installation kit are for RG400 type cable. SkyTrac Systems recommends the use of Emteq PFLX240-500 coax cable with a short pigtail using BNC connectors and RG400 coax cable for longer runs. If using another cable type, then an adaptor cable may need to be built. Additional regulatory approval will be required if the cable or connectors used are not specified in the applicable STC.

3.9 Connecting the Battery to the ISAT-200

The ISAT-200 is shipped with the battery mounted but not connected to the power board. This is to prevent the battery from being depleted before the ISAT-200 is installed in an aircraft. To connect your battery, please follow the instructions below:

1. Remove the eight screws on the side panel of the ISAT-200, and then remove the battery cover panel as shown in Figure 2 below.

2. Connect the battery to the power board. Insert the 4-pin battery cable connector into the battery connector (J2 for 101-200-03, J1 for 101-200-01), and push until it is securely in place.

3. Reinstall the battery cover panel with the eight screws that were previously removed.

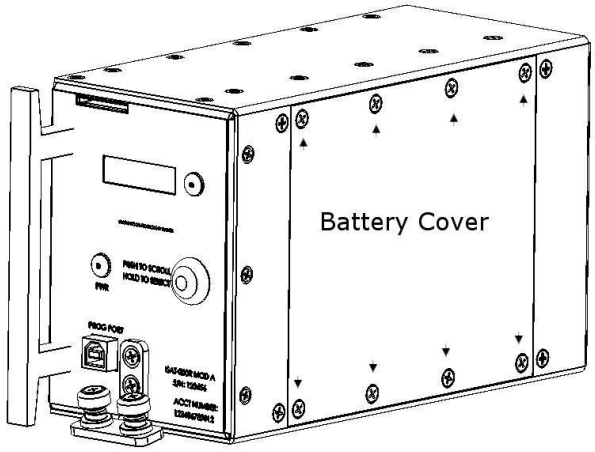

Figure 2 — ISAT-200 Side Panel Detail

For battery replacement and maintenance, refer to section 8: Maintenance and Continued Airworthiness.

CAUTION:
Use only an approved STS battery. Using an unapproved battery will damage your ISAT-200 and void the warranty.

3.10 Installing ISAT-200 into ITRAY-200

1. Slide the ISAT-200 into the tray from the front until it is snug.

2. Fasten the front hold down tab using the provided socket head cap screws, lock washers and washers. Tighten the bolts until the split ring is compressed, and then tighten at least another ¼ turn.

4 ELECTRICAL INSTALLATION

4.1 General

This section contains the information required to complete the electrical connections in an ISAT-200 system installation, including diagrams and tables that call out and list the contact locations of the connectors used in the installation. This section also includes system wiring diagrams with installation notes.

When installing the ISAT-200, the installer shall have a working knowledge of aircraft electronics installation and be a holder of either an FAA Repairman's Certificate or a Transport Canada equivalent. All installations should meet the requirements of FAA advisory circular AC43.13-1B.

IMPORTANT NOTICE:
All system interconnect cables must be connected before power is applied to the system.

4.2 Line Functions

This section describes the contact layout of the ARINC404 ITRAY-200R for completion of electrical installation purposes only. Included for the product is a drawing of the connector and a list of pin-outs with a detailed description of each connector pin-out group.

4.2.1 ITRAY-200R Pin-out

Note: In the following figures, Bay B refers to the upper bay connector (with 106 pins), and Bay A refers to the lower bay connector (with 30 pins).

The following figures illustrate the ARINC 404 pin callouts using drawings, pin names, and pin descriptions.

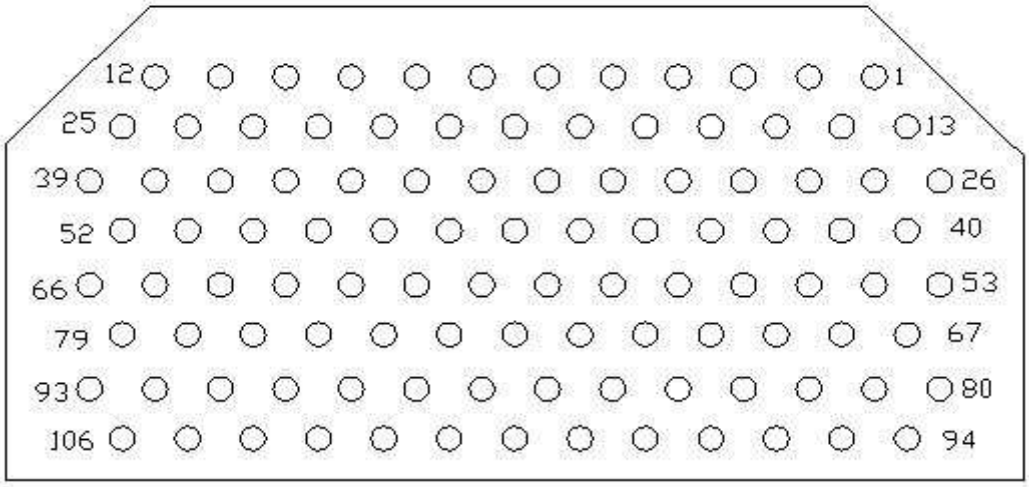

Figure 3— ARINC404 Bay B: 106 pin-out drawing

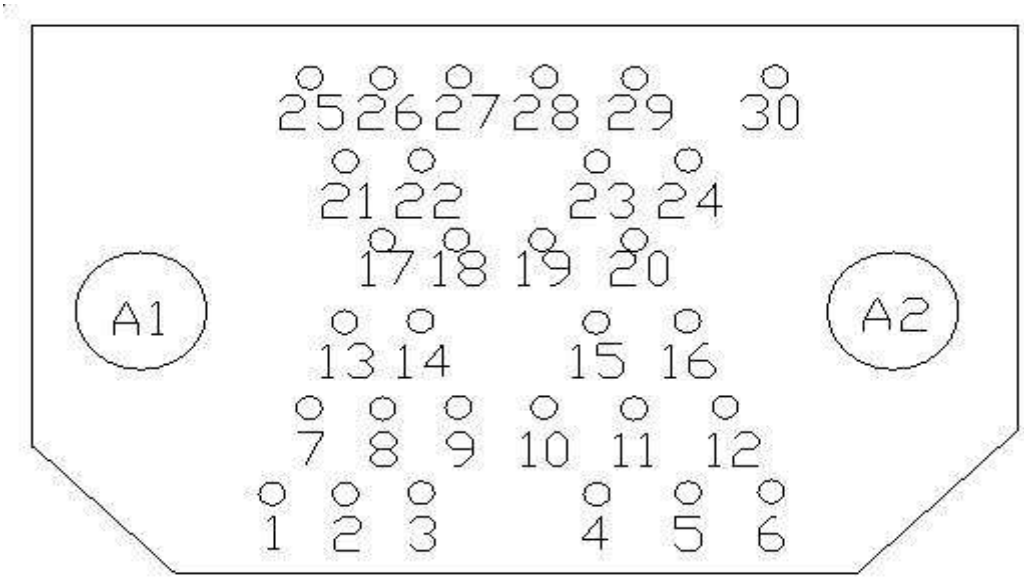

Figure 4 — ARINC404 Bay A: 30 pin-out drawing

Table 15— ARINC 404 Bay B: pin descriptions

ARINC Pin #	Pin Names	Description
1	RESERVED	Microphone Ground
2	MIC_IN+	Microphone In positive line
3	RESERVED	Microphone Ground
4	CH_GND	Chassis Ground
13	MIC_IN-	Microphone In negative line
14	RESERVED	Reserved, do no connect
15	GND	Analogue Ground
16	CH_GND	Chassis Ground
26	SPKR_GND	Speaker Ground
27	SPKR_600	Speaker 600
28	SPKR_300	Speaker 300
29	RS-485_B2	RS485 port 2 inverted line
30	CH_GND	Chassis Ground Ethernet
31	ETH IN-	Ethernet negative receive port
32-39	RESERVED	Reserved, do not connect
40	DI3	Digital Input 3
41	DIO_GND	Digital I/O Ground
42	RS485_GND2**	RS485 port 2 ground reference
43	RS-485_A2	RS485 port 2 non-inverted line
44	ETH IN+	Ethernet positive receive port
45-52	RESERVED	Reserved, do not connect
53	DO4	Digital Output 4
54	DO2	Digital Output 2
55	DO3	Digital Output 3
56	DI5	Digital Input 5
57	ETH OUT-	Ethernet negative transmit port
58-66	RESERVED	Reserved, do not connect
67	ADC2	Analogue Input 2 (Reserved. Do not use.)
68	ADC3	Analogue Input 3 (Reserved. Do not use.)
69	ADC4	Analogue Input 4
70	ETH OUT+	Ethernet positive transmit port
71-79	RESERVED	Reserved, do not connect
80	ADC5	Analogue Input 5
81	RS-485_Y2*	RS485 port 2 non-inverted line (4 wire mode)*
82	RS-485_Z2*	RS485 port 2 inverted line (4 wire mode)*
83-106	RESERVED	Reserved, do not connect

* RS485 4 Wire Mode is only available on ISAT-200R P/N: 101-200-03

** RS-485_GND2 is isolated within the ISAT-200 system. RS-485_GND2 needs to be connected to aircraft ground for reliable operation of the RS-485 databus.

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Table 16 — ARINC 404 Bay A: pin descriptions

ARINC Pin #	Pin Names	Description
1	SPI MISO	Reserved for CM*, do not connect
2	GND	Reserved for CM*, do not connect
3	+3V3SW	Reserved for CM*, do not connect
4	DI4	Digital Input 4
5	DI2	Digital Input 2
6	DI1	Digital Input 1
7	TRAY_MOSI	Reserved for CM*, do not connect
8	TRAY_SCLK	Reserved for CM*, do not connect
9	SPI_TRAY_CS	Reserved for CM*, do not connect
10	DIO_GND**	Digital I/O Ground
11	DI6	Digital Input
12	DO1	Digital Output 1
13	AUX_PWR	Auxiliary Power Output
14	AUX_GND	Auxiliary GND
15	PWR	External Power Input (28V)
16	GND	28V return ground
17	CH_GND	Chassis Ground
18	CH_GND	Chassis Ground
19	CH_GND	Chassis Ground
20	CH_GND	Chassis Ground
21	S1_GND	Serial 1 Ground
22	S2_GND	Serial 2 Ground
23	RS485_A1	RS485 port 1 non-inverted line
24	RS485_B1	RS485 port 1 inverted line
25	RS232_RX1	Serial 1 receiver
26	RS232_TX1	Serial 1 transmitter
27	RS232_RX2	Serial 2 receiver
28	RS232_TX2	Serial 2 transmitter
29	RS485_GND1***	RS485 port 1 ground reference
30	ADC1	Analogue input 1
A1	IRIDIUM ANT	Iridium antenna cable
A2	GPS ANT	GPS antenna cable

* CM = Configuration Module - The configuration module comes pre-wired.

** DIO_GND must be connected to aircraft ground for the digital inputs to function correctly.

*** RS-485_GND1 is isolated within the ISAT-200 system. RS-485_GND1 needs to be connected to aircraft ground for reliable operation of the RS-485 databus.

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4.2.2 Digital Ground Seeking Inputs

Ground seeking pins indicate a logical TRUE to the microcontroller if the input is grounded.

Table 17—Digital Ground Seeking Input Descriptions

ISAT-200R Pin #		Description and recommended usage
Bay A	Bay B	
11		Asserted when ground is applied.
6		Asserted when ground is applied. Recommended to be used for external emergency toggle switch.
5		Asserted when ground is applied. Recommended to be used with flight event as a toggle switch.
	40	Asserted when ground is applied. Recommended for general use.
	56	Asserted when ground is applied. Recommended to be used as Engines On/Off toggle switch.

Note: All Digital Inputs are referenced to the ISAT-200 DIO GND. ISAT-200 DIO_GND is isolated from the system ground; DIO_GND must be connected to aircraft ground for the digital inputs to function correctly.

The status of the digital inputs can be checked from the ISAT-200 Menu. Please refer to the ISAT-200 User Guide for help navigating the menu.

4.2.3 Digital Voltage Seeking Inputs

Table 18—Digital Voltage Seeking Input Descriptions

ISAT-200R Pin #		Description and recommended usage
Bay A	Bay B	
4		Asserted when 28V is applied. Recommended to be used as a mission event toggle switch.

Note: All Digital Inputs are referenced to the ISAT-200 DIO GND. ISAT-200 DIO_GND is isolated from the system ground; DIO_GND must be connected to aircraft ground for the digital inputs to function correctly.

The status of the digital inputs can be checked from the ISAT-200 Menu. Please refer to the ISAT-200 User Guide for help navigating the menu.

If more voltage seeking inputs are required, some of the analogue inputs can be configured as voltage seeking inputs. See section 4.2.7: Analogue Inputs.

4.2.4 RS-485 Data ports

These are the RS-485 two-wire, half-duplex, multipoint serial communication channels used to transfer data to and from auxiliary devices. These lines are used to communicate with the peripheral devices such as the CDU-300.

Table 19—RS-485 Port 1 Descriptions

ISAT-200R	Description and recommended usage
Bay A Pin #	Recommended port for connection to STS peripherals.
23	RS-485-A Non Inverted Input/Output Line
24	RS-485-B Inverted Input/Output Line
29	RS-485 ground reference

Table 20—RS-485 Port 2 Descriptions

ISAT-200R	Description and recommended usage
Bay B Pin #	General purpose data port
43	RS-485-A Non Inverted Input/Output Line
29	RS-485-B Inverted Input/Output Line
81	RS-485-Y Non-inverted Output (4 wire mode)*
82	RS-485-Z Inverted Output (4 wire mode)*
42	RS-485 ground reference*

Note: RS-485 Port 2 shares some circuits with RS-232 Port 2. Only one of these ports can operate at the same time. The functional port is selected via SkyWeb.

Note: RS-485 4 wire mode is only available on ISAT-200R P/N: 101-200-03

Note : RS-485_GND is isolated within the ISAT-200 system. RS-485_GND needs to be connected to aircraft ground for reliable operation of the RS-485 databus.

4.2.5 RS-232 Data ports

These are the RS-232 ports used for sending and receiving serial binary data signals to and from peripheral devices.

Table 21—RS-232 Port 1 Descriptions

ISAT-200R	Description and recommended usage
Bay A Pin #	Recommended port for connection to STS peripherals
26	TX – Data out of ISAT-200
25	RX – Data into ISAT-200
21	Serial data ground reference

Table 22—RS-232 Port 2 Descriptions

ISAT-200R	Description and recommended usage
Bay A Pin #	General purpose data port
28	TX – Data out of ISAT-200
27	RX – Data into ISAT-200
22	Serial data ground reference

Note: RS-485 Port 2 shares some circuits with RS-232 Port 2. Only one of these ports can operate at the same time. The functional port is selected via SkyWeb.

4.2.6 Ethernet Port

Table 23—Ethernet Port Descriptions

This is the Ethernet wire set used to transmit data to and from auxiliary devices.

ISAT-200R Bay B Pin #	Description and recommended usage
57	Ethernet transmit port OUT-
70	Ethernet transmit port OUT+
31	Ethernet transmit port IN-
44	Ethernet transmit port IN+

4.2.7 Analogue Inputs

Table 24—Analogue Input Descriptions

ISAT-200R Pin #		Description and recommended usage
Bay A	Bay B	
30		Analogue Input Channel 1*
	67	Analogue Input Channel 2 (Reserved. Do not use)
	68	Analogue Input Channel 3 (Reserved. Do not use)
	69	Analogue Input Channel 4*
	80	Analogue Input Channel 5*

* Analogue inputs 1, 4 and 5 can be configured as voltage seeking digital inputs. Analogue input 1 is the recommended alternate input for Engines On/Off toggle switch if a voltage seeking input is required.

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4.2.8 Auxiliary Power Output

Table 25—Auxiliary Power Description

ISAT-200R Bay A Pin #	Description and recommended usage
13	6 VDC, 0.8 A short circuit protected, thermal shutdown protected.
14	Auxiliary Output Ground

IMPORTANT NOTICE:
The auxiliary power output does not operate when the ISAT is operating under internal battery power.

4.2.9 External Power Input (28V)

Table 26—External Power Input Description

ISAT-200R Bay A Pin #	Description and recommended usage
15	This pin connects to the aircraft power systems and supply power to the ISAT-200
16	Power Ground (28VDC Return)

4.2.10 Audio Lines

Table 27—Audio Line Description

ISAT-200R Bay B Pin #	Description and recommended usage
1	Microphone ground
2	Microphone positive input
13	Microphone negative input
26	Speaker negative
27	Speaker positive 600 ohm output
28	Speaker positive 300 ohm output

4.2.11 ITRAY-200 Communication Lines

The ISAT-200 has several pins which communicate with the Configuration Module on the ITRAY-200. These pins are pre-wired at the factory and are not for use by the aircraft installer.

Table 28—ITRAY-200 Communication Line Description

ISAT-200R Bay A Pin #	Description and recommended usage
1, 2, 3, 7, 8, 9	Power supply and data bus to ITRAY-200

4.3 Example Installation drawings and BOM

Approved installation drawings from the appropriate STC should be used for installation of the ISAT-200 System.

Please refer to the ISAT-200 System Installation Reference Drawings (DOC0461) for reference when an STC is not applicable.

4.3.1 ISAT-200 Installation Wiring Diagram Notes

The following notes pertain, in general, to the ISAT-200 Installation Wiring Diagram Illustrations.

IMPORTANT NOTICE:
All system interconnect cables must be connected before power is applied to the system.

All signal and power shield continuity must be individually maintained through bulkhead disconnects.

Please refer to the ISAT-200 System Installation Reference Drawings or STC drawings for additional installation notes.

5 CONFIGURATION OF THE ISAT-200

5.1 General

This section contains instructions for configuring the ISAT-200.

5.2 Installation Configuration

A number of audio configuration items need to be done. These are divided into two sections, those that need to be done by the installer and those than can be done by the user.

This section needs to be completed if audio installation is to be done. The installer can use the ISAT-200 menu system or the DVI-300/CDP-300/CDU-300 to configure the system. If using a peripheral, please refer to the peripheral installation manual for more details.

Please follow the below instructions if using the ISAT-200 menu for audio configuration.

5.2.1 Installer Audio Configuration Items

Audio Input Level

The audio input level can be selected to a low range designed to connect to microphones, or to a high range designed to accept up to 1.4V RMS.

To select the audio input level, use the ISAT-200 menu: System->Audio->Audio In. Select “Lo Level” for low input range for microphones or “Hi Level” for high input range, up to 1.4VRMS.

Microphone DC Bias

Microphone DC Bias can be selected as either ON or OFF via the ISAT-200 Menu. Use the System->Audio->Mic Bias to toggle the DC Bias (ON) or No Bias (OFF) Setting.

Microphone Gain Setup

To set the amount of gain on the microphone input selection use the ISAT-200 menu System->Audio->Mic Gain and select either “6db” or “18db”.

Ring Tone

One of five ring tones can be selected via menus on either the ISAT or the peripheral. Connect your headset to the ISAT so that you can listen to the tones.

To select a ring tone, go to the System->Audio->Ringtone menu. Toggling through the choices will display “1” then “2” etc. As each number is displayed, the associated Ring Tone will sound for one second in the headset. Select the desired ring tone. Select “Go Back” to return to the previous menu.

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To set the ring tone volume go to System>Audio>Ring Vol. Select this item, toggle through the choices “Go Back”, “1”, “2”, etc. Selecting any number will set the Ringer Volume to that level. Start by selecting “4”. Go back and try to select a Ringtone. If the selected ringtone is not heard, increase the ringtone volume and try again.

Only nominal audio output impedance, microphone bias, microphone input range and ring tone need to be selected by the installer, the rest can be configured by the user. Audio configuration includes configuring the audio volume, microphone gain, side tone volume, microphone bias, microphone input range, nominal audio output impedance and ring tone.

5.3 System Configuration

System configuration includes setting the registration number in the ITRAY-200, configuring position reporting information, input operation, and other parameters. This configuration is performed within SkyTrac’s Hardware Management section in SkyWeb. Please refer to SkyWeb documentation available on the SkyTrac Website at www.skytrac.ca for more information on how to configure the unit. Once the unit is configured, use SkyWeb as instructed to verify correct configuration.

6 POST INSTALLATION TESTS

6.1 General

This section contains instructions for the tests to be performed after installation in order to confirm that the system has been installed correctly. Post installation tests are mandatory for all ISAT-200 installations.

6.2 Function Test

The avionics installer must perform this test immediately after installation.

1. Move aircraft to a location with unrestricted visibility of the sky.

2. Power on unit on by turning on mains power.

3. Use the ISAT-200 menu system to check the status of the Iridium Signal and the GPS signal. A single push (press and release) of the button will scroll through the menu one item at a time, while pressing and holding the button will select a menu item. The status of the GPS and Iridium signals can be checked under the Info menu. A GPS sat count of 4 or better and GPS Lock confirms correct installation of the GPS portion. A MDM Sig strength of 2 or better confirms correct installation of the Iridium portion.

4. Test proper position reporting at the default interval setting (1 minute). An acceptable method for testing position reporting is to use STS flight following software to check if a valid position and GPS time is reported for the installed ISAT-200. Inform the local SkyTrac Program Manager to change the default position interval (via SkyWeb) to another interval if required. Failure to do so will result in position report charges at one minute intervals.

5. Check all ISAT-200 digital inputs that are required and verify that each input gives the expected result. The digital inputs can be checked from the ISAT-200 Menu as follows:

    a. Scroll to System -> Test -> Dig I/P
    b. A six digit binary number is displayed (for example: 001001). The left most digit represents digital input 1, while the right most digit represents digital input 6.
    c. Activate one of the digital inputs and check that the appropriate digit is changed from 0 to 1. De-activate the input and check that the same digit changed from 1 to 0. Note that the logic may be inverted from the intended function. This can be handled during the remote configuration of the ISAT-200.
    d. Repeat step c for each digital input used in the ISAT-200 installation.

6. Check all ISAT-200 digital outputs that are required and verify that each output gives the expected result. The digital outpus can be checked from the ISAT-200 menu as follows:

    a. Scroll to System -> Test -> Output
    b. The menu will scroll through each digital output and toggle the value – from deactivated to activated and back to deactivated.
    c. Verify that activating the digital output has the desired result

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7. Check all ISAT-200 analog inputs that are required and verify that each input gives the expected result. The analog inputs can be checked from the ISAT-200 menu as follows:

    a. Scroll to System -> Test -> Ana I/P
    b. The menu will scroll through each analog input and display the input voltage.
    c. Change one of the analog inputs and check that the analog input value increases or decreases appropriately.
    d. Repeat step c for each analog input used in the ISAT-200 installation.

8. If an audio interface is installed, place and receive a phone call and ensure that all audio is clear and of an appropriate volume. (It is recommended that this step be performed with the engines on so that a typical level of background noise is present.)

9. Check that any installed peripheral devices are able to detect and communicate with the ISAT-200. Refer to the peripherals installation manual and user guide for instructions specific to the device.

6.3 EMI Test

Please refer to ISAT-200 System EMI-RFI Test Template DOC0478 (latest revision) for testing procedures.

The purpose of the EMI test report is to verify that the operation of the ISAT-200 does not interfere with basic aircraft systems and avionics.

Most of the EMI tests can be accomplished on the ground; however, in some cases flight testing is required. **If the aircraft is approved for IFR operations, then it is mandatory that interference between the ISAT-200 and the approach aids be checked in-flight.**

The EMI test includes the following steps and system checks:

- Operate the unit until at least 10 position reports are sent.
- The existing on-board GPS should be operational and navigating with at least the minimum complement of satellites.
- The VHF Comm. should be set to commonly-used frequencies with the squelch open.
- VOR/DME receivers should be selected for display.
- If possible, set up a DME ramp test set on the frequencies indicated and adjust the output until the flags are out of view.
- The transponder and encoder should be monitored with ramp test equipment.
- Set the output of the transponder test set to 3 db above the output necessary to achieve 90% reply.
- If possible, set the ADF to a nearby navigation station.

List the power plant, fuel and other electric instruments on the EMI/RFI Test Report and note any anomalies that occur while transmitting. Assess the results.

If the aircraft is equipped with an autopilot or stability augmentation system, then test fly the aircraft and verify that operation of the ISAT-200 unit does not have adverse effects on these systems. After checking for gross effects at a safe altitude, fly an approach with each of the different navigation systems coupled to the autopilot (ILS, GPS ETC.) and look for any anomalies.

If the installed system passes all of the applicable EMI tests, then no further action is required. If interference is observed then the interference must be assessed against the appropriate standards of airworthiness for the system in question. For example it is permissible for a VFR certified GPS to lose navigation capability under certain conditions, providing that it recovers properly and promptly, but it is not permissible for an IFR Approach certified GPS to be affected in the same way. A complete discussion of all the standards of airworthiness to be applied in assessing EMI effects is beyond the scope of this document.

7 AIRWORTHINESS LIMITATIONS

7.1 Installation Limitations

As per FAA Policy No. ASW-2001-01 dated April 25, 2002, the antenna must not be installed 0.5 meters or less from a FADEC system.

7.2 Operation Limitations

GPS information provided by the ISAT-200 is not intended for navigational purposes.

Operating the battery pack below -10℃ results in r educed performance.

The ISAT-200 field-replaceable Li-ion battery has a charging temperature range from 0 degrees Celsius to 45 degrees Celsius. A unique user notification will be sent to the ground user when the ISAT-200 battery voltage becomes low. If the battery is not charged, the ISAT-200 will not be able to perform its battery only power requirements (please see the SkyWeb Administrator's Guide for details).

Use only the ISAT-200 or chargers approved by SkyTrac Systems to charge the battery pack. Use of other chargers may damage the battery pack and increase the risk of heat, explosion or fire.

STS is not responsible for the damage caused to the Li-ion battery pack by mishandling. (The pack refers to the ISAT-200 Li-ion battery pack; PN: STS0044 or STS0061)

- Do not short-circuit the pack.
- Do not pierce or strike with a hammer, step on or otherwise subject to a strong impact.
- Do not dispose of the pack in a fire or heat it intentionally.
- Do not use the battery in reverse polarity.
- Do not allow the pack to be immersed in water.
- Do not disassemble or modify the pack.

There is a safety mechanism incorporated into every pack cell to prevent damage to the pack or the ISAT-200.

A damaged safety mechanism or mishandling of the battery pack may cause heat, explosion or fire.

CAUTION:
Do not operate or store the battery pack above 60 degrees Celsius ambient temperature.

Refer to the battery datasheet in Appendix B for more information.

8 MAINTENANCE AND CONTINUED AIRWORTHINESS

8.1 Continued Airworthiness

Periodic inspection is required as follows:

- Operator is to inspect the Mains Power breaker once every six months to verify proper operation of the breaker.

- Operator is to inspect the ISAT-200 battery once every year to verify the battery is in good working condition. Open the battery compartment and visually inspect the battery. Inspect for leaked electrolyte and damaged or discoloured PVC covering of the battery.

- If the ISAT-200 is not installed in an actively flying aircraft for a period of time that is greater than 3 months, the battery must be electrically disconnected from the ISAT-200 unit and stored following the battery cell manufacturer's recommendations. It is not recommended that the battery be stored for more than one year or loss of capacity will result.

- If the battery is completely depleted due to continued operation of the ISAT-200 unit out of the charge operational temperature range, the battery should be fully charged within the correct temperature range. This can be done by powering up the ISAT-200 unit within the battery charge operational temperature range for six hours or by using an approved desktop charger.

CAUTION:
If the battery has leaked electrolytes, gets hot during charging, or emits odours, do not use the battery. Contact SkyTrac Systems Ltd if this should occur.

8.2 Maintenance Instructions

The ISAT-200 Li-ion battery capacity will decrease as the battery undergoes normal usage and aging. The rate of capacity reduction depends greatly on the usage characteristics and operational temperature. For this reason, the battery must be monitored for replacement.

If the battery charge becomes critically low, a battery alert message will be sent to the base station, a low battery alert will be displayed on the ISAT-200.

If the battery is installed in an actively flying aircraft in above 0 degrees Celsius and battery low warning is issued, the battery may need to be replaced. A low battery warning on consecutive flights within the battery operational temperature range indicates that the battery is no longer successfully retaining its charge and the battery should be replaced. If the ISAT-200 is not transmitting it's mains off report, the battery needs to be replaced.

Periodic inspection is also required as per the Continued Airworthiness Section.

The Li-ion Battery Pack (PN: STS0044 or STS0061) must be replaced under the following conditions:

- The battery no longer maintains a satisfactory charge
- The battery will not charge
- The battery gets hot during charging or emits an odour (contact SkyTrac Systems should this occur)

8.2.1 Battery Replacement Instructions

Replace the ISAT-200 battery only with an approved STS ISAT-200 battery, or damage to the ISAT-200 and/or the battery may result. Use of another battery may present a risk of fire or explosion.

CAUTION: Battery May Explode If Mistreated. Do Not Disassemble Or Dispose Of In Fire.

Do not install STS0044 in an ISAT-200 with mod status D.

To replace the battery, follow the instructions below:

1. Remove the ISAT-200 from the ITRAY-200.
2. Remove the battery cover from the ISAT-200.
3. Disconnect the battery connector from the ISAT-200.
4. Cut the cable ties securing the battery to the ISAT-200 battery cover, begin careful not to damage the old battery case. Recycle or safely dispose of the old battery.
5. Mount the new battery, lining up the battery ends with the battery mounting foam. Make sure that the “bump on the battery is not in contact with the cable ties and is parallel to the battery cover or it won’t fit in the enclosure well.
6. Install provided cable ties (or equivalent) to secure the battery to the mounting brackets. Tighten the cable ties to 28 +/- 4in-lbs.
7. Visually inspect the battery installed to ensure secure installation.
8. Connect the battery connector to the ISAT-200.
9. Install the battery cover.
10. If replacing STS0044 with STS0061, circle mod status D on the ISAT-200 serial number label with a permanent marker.
11. Install the ISAT-200 in the ITRAY-200.
12. Power up the ISAT-200 by applying aircraft power to the unit and wait 1 minute.
13. Disconnect aircraft power from the ISAT-200.
14. Verify that the battery operates. Acceptable methods for doing this include verifying a 'Mains OFF' report is received by the base station or observing the ISAT-200 display and verifying that the display operates briefly after the ISAT-200 main power is removed.
15. All Panasonic Lithium-ion batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling by your local battery recycling agency. Please call 1-800-8-BATTERY for information on recycling your used Lithium-ion battery or go to the RBRC website at www.rbrc.org for additional information.

9 FIRMWARE UPDATES

The ISAT-200 is equipped with a USB interface and a SD Card slot to enable firmware updates to the device. Detailed instructions on how to update the firmware are included in the ISAT-200 User's Guide.

Refer to SkyTrac's website at www.skytrac.ca for a list of firmware updates available or contact SkyTrac Client Services.

IMPORTANT NOTE:
Depending on the time period between shipping of your unit and the physical installation at your location, firmware upgrades may become available. It is recommended that you check with SkyTrac Systems Client Services to confirm if any upgrades are available for your unit as part of the installation process.

10 ISAT-200 HUMAN MACHINE INTERFACE

10.1 General

This section provides a brief description of each of the ISAT-200 human machine interface components. For more detailed information on each of these components, refer to the ISAT-200 User's Guide.

10.2 Display

The ISAT-200 includes an 8-character display for assistance during configuration and troubleshooting.

10.3 LED

The LED on the ISAT-200 will indicate power and alert status. A steady green LED indicates the ISAT-200 has power and is operating normally. An amber LED indicates an 'Alert' or error message is waiting to be viewed on the display.

10.4 Button

The black button on the ISAT-200 is used for scrolling through the menu and accessing different configuration options and error messages. A single push (press and release) of the button will scroll through the menu one item at a time, while pressing and holding the button will select a menu item.

10.5 Ambient Light Sensor

Beside the display is an Ambient Light Sensor which will automatically detect the ambient light level.

10.6 USB Programming Port

The USB programming port is used for updating the ISAT-200 firmware directly from a computer running Windows XP or later.

10.7 SD Card Slot

The SD Card slot is used for updating the ISAT-200 firmware when a computer is not available.

Restricted Proprietary and Confidential Information

11 APPENDICES

11.1 Appendix A: Causes of RF Interference

Some subscribers have contacted Iridium® regarding the loss of signal quality when they operate their equipment near active INMARSAT terminals.

The power with which INMARSAT units transmit can overpower the Iridium® unit's ability to properly maintain a quality connection with the Iridium® satellite constellation. INMARSAT terminals are often found in the same locations as Iridium® subscribers' — generally airports and harbors (especially aboard naval vessels).

In relation to the Iridium® unit's antenna, the location of the INMARSAT unit's antenna plays a significant role in determining the degree of signal degradation an Iridium® subscriber will experience. All Iridium® units are susceptible to this interference, regardless of the type of antenna being used.

Susceptibility to interference from an INMARSAT terminal applies to all Iridium® end-user products (9500 and 9505 equipment, including the L-Band Transceiver (LBT), which is contained in products developed by SkyTrac Systems). Generally speaking, an Iridium® unit located within 15 to 45 meters (50 to 150 feet, respectively) of an operating INMARSAT mini-M or Standard-C terminal, will likely experience interruption in the unit's performance.

Other sources of RF interference such as Globalstar® units, radar devices, and broadcast stations can cause interference for Iridium® units, but usually are not encountered as frequently as INMARSAT terminals.

Mitigation of RF Interference

Degradation of service due to RF interference to the Iridium® unit can be significantly improved by performing either or both of the following actions:

a) Increasing the distance and moving the Iridium® antenna off axis from the source of the interference, or

b) Using an external band pass filter and an external antenna.

In determining the optimal location for mounting an external Iridium® antenna in a location where INMARSAT antennae are also located, *be certain that the Iridium® antenna is mounted to the side or behind the INMARSAT antenna as well as above or below it.* Also note that the length of the feed line (the cable running from the Iridium® unit to the antenna) plays an important role in the performance of the unit.

11.2 Appendix B: Battery Precautions

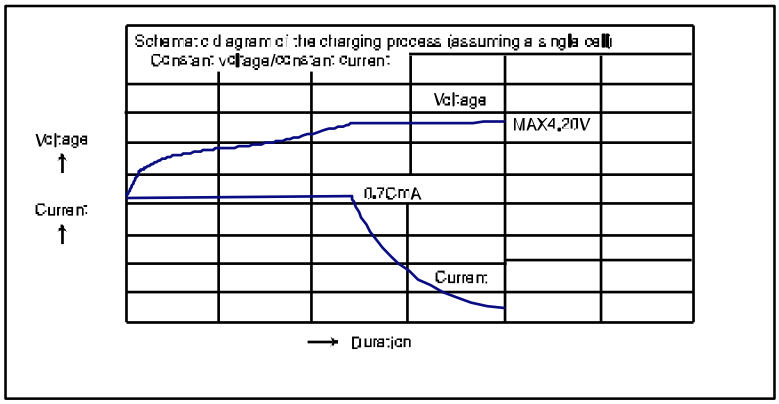
Safety Precautions for the Lithium Ion Battery Pack

Use of Lithium Ion Batteries and the Design of Equipment That Uses These Batteries

In general, lithium ion batteries are used in battery packs that contain both lithium ion batteries and battery protection circuits. Both items are sealed in a container made of a material such as resin so that the battery pack cannot be easily disassembled.

1. Charging the Batteries

The “constant voltage/constant current” method is used to charge lithium ion batteries. (See Figure below.)



(1) Charge Voltage

The maximum voltage is 4.2 V x the number of cells connected in series.

(2) Charge Current

We recommend 0.7 CmA.
When the voltage per cell is 2.9V or less, charge using a charge current of 0.1CmA or less.
(Contact Panasonic for information regarding pulse charging.)

(3) Charge Temperature

The batteries should be charged at temperatures between 0℃ and 45℃.

(4) Reverse-polarity Charging

Verify the polarity of the batteries before charging to ensure that they are never charged with the polarity reversed.

2. Discharging the Batteries

(1) Discharge Current

The current should be maintained at 1.0 CmA or less (Consult Panasonic if you plan to discharge the batteries with a current in excess of 1.0 CmA).

(2) Discharge Temperature

The batteries should be discharged at a temperature between -20℃ and +60℃.
(Consult Panasonic if you plan to discharge the batteries at temperatures less than -10℃.)

(3) Discharge Termination Voltage

Avoid discharging at voltages less than 3.0 V per cell. Over discharge can damage the performance of the battery. Equip the unit with a mechanism to prevent over discharge, especially in situations where the user may forget to turn the equipment off.

This information is generally descriptive only and is not intended to make or imply any representation, guarantee or warranty with respect to any cells and batteries. Cell and battery designs/specifications are subject to modification without notice. Contact Panasonic for the latest information.

3. Equipment Design

(1) Installing Battery Packs in the Equipment

To avoid damage to the battery pack, make sure that the battery pack is positioned away from heat sources in the equipment or in the battery charger.

(2) Mechanisms to Prevent Dropping

Be sure to use a battery pack lock mechanism to prevent the battery pack from being ejected when the equipment is dropped or receives a sudden impact.

(3) Preventing Short Circuits and Reversed Connections

Use a terminal structure that makes it unlikely that the terminals will be shorted by metallic necklaces, clips, hairpins, etc. Structure the battery and the terminals to the battery in sub˜†a way that the battery pack cannot be put in backwards when installed in the charger or the equipment.

(4) Inclusion in Other Equipment

If the battery is built into other equipment, use caution to strictly avoid designing airtight battery compartments.

(5) Terminal Materials in the External Equipment

Use materials that are highly resistant to corrosion (such as nickel or nickel-coated copper). If contact resistance is an issue, we recommend that you use contact plating (such as gold plating) on the terminals.

4. Storing the Batteries

The batteries should be stored at room temperature, charged to about 30 to 50% of capacity.
We recommend that batteries be charged about once per year to prevent overdischarge.

5. Use of the Batteries

See the section on “Safety Precautions for the Lithium Ion Battery Pack.”

6. Other

The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

7. Please Note

The performance and life expectancy of batteries depends heavily on how the batteries are used. In order to ensure safety, be sure to consult with Panasonic in advance regarding battery charging and discharging specifications and equipment structures when designing equipment that includes these batteries.

Please Note:

Panasonic assumes no liability for problems that occur when the Notes and Precautions for use listed above are not followed.

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SAFETY PRECAUTIONS FOR LITHIUM ION BATTERY PACKS

• Safety Warnings

1. When Using the Battery

! WARNING

1. Misusing the battery may cause the battery to get hot, rupture, or ignite and cause serious injury. Be sure to follow the safety rules listed below:
    - Do not place the battery in fire or heat the battery.
    - Do not install the battery backwards so that the polarity is reversed.
    - Do not connect the positive terminal and the negative terminal of the battery to each other with any metal object (such as wire).
    - Do not carry or store the batteries together with necklaces, hairpins, or other metal objects.
    - Do not pierce the battery with nails, strike the battery with a hammer, step on the battery, or otherwise subject it to strong impacts or shocks.
    - Do not solder directly onto the battery.
    - Do not expose the battery to water or salt water, or allow the battery to get wet.
2. Do not disassemble or modify the battery. The battery contains safety and protection devices which, if damaged, may cause the battery to generate heat, rupture or ignite.
3. Do not place the battery on or near fires, stoves, or other high-temperature locations. Do not place the battery in direct sunshine or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, rupture, or ignite. Using the battery in this manner may also result in a loss of performance and a shortened life expectancy.

! CAUTION

1. If the device is to be used by small children, the caregiver should explain the contents of the user's manual to the children. The caregiver should provide adequate supervision to ensure that the device is being used as explained in the user's manual.
2. When the battery is worn out, insulate the terminals with adhesive tape or similar materials before disposal.
3. Immediately discontinue use of the battery if, while using, charging, or storing the battery, the battery emits an unusual smell, feels hot, changes color, changes shape, or appears abnormal in any other way. Contact your sales location or Panasonic if any of these problems are observed.
4. Do not place the batteries in microwave ovens, high-pressure containers, or on induction cookware.
5. In the event that the battery leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated the battery fluid could cause damage to the eye.

2. While Charging

! WARNING

1. Be sure to follow the rules listed below while charging the battery. Failure to do so may cause the battery to become hot, rupture, or ignite and cause serious injury.
    - When charging the battery, either use a specified battery charger or otherwise ensure that the battery charging conditions specified by Panasonic are met.
    - Do not attach the batteries to a power supply plug or directly to a car's cigarette lighter.
    - Do not place the batteries in or near fire, or into direct sunlight. When the battery becomes hot, the built-in safety equipment is activated, preventing the battery from charging further, and heating the battery can destroy the safety equipment and can cause additional heating, breaking, or ignition of the battery.
2. Do not continue charging the battery if it does not recharge within the specified charging time. Doing so may cause the battery to become hot, rupture, or ignite.

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! CAUTION

3. The temperature range over which the battery can be charged is 0℃ to 45℃. Charging the battery at temperatures outside of this range may cause the battery to become hot or to break. Charging the battery outside of this temperature range may also harm the performance of the battery or reduce the battery's life expectancy.

3. When Discharging the Battery

! WARNING

1. Do not discharge the battery using any device except for the specified device. When the battery is used in devices aside from the specified device it may damage the performance of the battery or reduce its life expectancy, and if the device causes an abnormal current to flow, it may cause the battery to become hot, rupture, or ignite and cause serious injury.

! CAUTION

2. The temperature range over which the battery can be discharged is -20℃ to 60℃. Use of the battery outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.

To ensure the safe use of this battery, contact Panasonic when designing a device that uses this battery.

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